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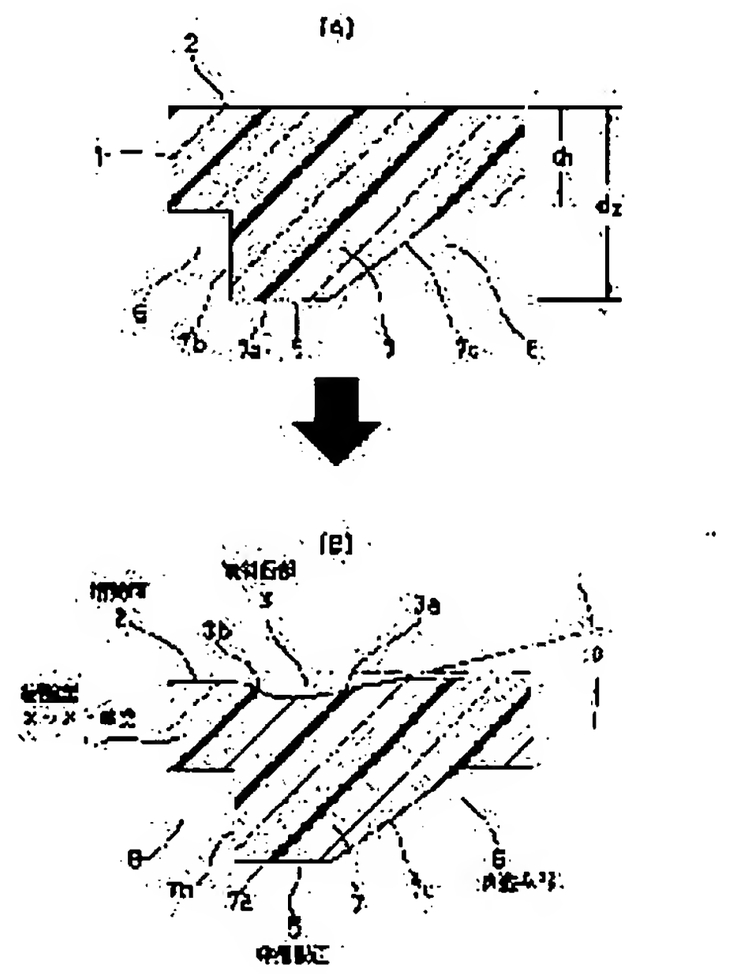
(54) MANUFACTURING METHOD FOR RESIN THRUST BEARING

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a manufacturing method for a resin thrust bearing 1 capable of easily forming a recessed part such as a slant face part 3 or a step part in a sliding face 2 of the thrust bearing 1 to easily manufacture the thrust bearing 1 with high accuracy.

SOLUTION: In the manufacturing method for the resin thrust bearing 1 having the recessed part such as the slant face part 3 or the step part in the sliding face 2, the sliding face 2 is formed into a planar state, and a non-sliding face 5 is formed with a thinning part 6. The undercut part 6 is disposed in a position corresponding to a portion in the sliding face 2 not formed with the recessed part. The recessed part is formed in the sliding face 2 by use of contraction of a resin material after molding.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In the manufacture approach of the thrust bearing made of resin (1) of having crevices, such as the inclined plane section (3) or the level difference section (4), in a sliding surface (2) While fabricating said sliding surface (2) to a plane, the meat theft section (6) is fabricated to a non-sliding surface (5). The shaping location of said meat theft section (6) in said non-sliding surface (5) is a location corresponding to the part which does not form said crevice in said sliding surface (2). The manufacture approach of the thrust bearing made of resin characterized by forming said crevice in said sliding surface (2) using the die shrinkage of the resin ingredient after shaping.
[Claim 2] In the manufacture approach of the thrust bearing made of resin (1) of having crevices, such as the inclined plane section (3) or the level difference section (4), along one edge of said run slot (8) while having a run slot (8) in a sliding surface (2) While fabricating said run slot (8) to said sliding surface (2), the meat theft section (6) is fabricated to a non-sliding surface (5). The shaping location of said meat theft section (6) in said non-sliding surface (5) is a location corresponding to the location of the flute width direction asymmetry of said run slot (8) in said sliding surface (2). The manufacture approach of the thrust bearing made of resin characterized by forming said crevice in said sliding surface (2) using the die shrinkage of the resin ingredient after shaping.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the shaping approach of a resin product, and relates to the manufacture approach of the thrust bearing made of resin especially. This thrust bearing made of resin is used for the thrust bearing section of the revolving shaft in cars, such as an automobile.
[0002]
[Description of the Prior Art] From the former, the thrust bearing 51 made of resin shown in drawing 5 (A) is known, and the inclined plane section 53 shown in this drawing (B) for the purpose of acquiring the dynamic pressure effectiveness at the time of actuation to the sliding surface 52 of this thrust bearing 51 made of resin and the crevice of level difference section 54 grade shown in this drawing (C) are established in the required-number radial. The inclined plane section 53 of this drawing (B) is a crevice equipped with base 53a carried out a predetermined include-angle theta inclination to a sliding surface 52, and the bearing which formed this inclined plane section 53 may be called "tapered land bearing." Moreover, the level difference section 54 of this drawing (C) is a crevice equipped with parallel base 54a to the sliding surface 52, and the bearing which formed this level difference section 54 may be called "step DORANDO bearing." These inclined plane sections 53 and the crevice of level difference section 54 grade are formed considering the magnitude as a minute thing, in order to acquire the big dynamic pressure effectiveness.
[0003] However, it sets to the manufacture approach of the thrust bearing 51 made of resin by the conventional metal mold shaping. In order to fabricate these inclined plane sections 53 and the crevice of level difference section 54 grade to the thrust bearing 51 made of resin which is mold goods The thrust bearing 51 made of resin is fabricated using the metal mold which formed heights in the inside of the shaping cavity of metal mold (not shown) beforehand corresponding to these inclined plane sections 53 or the crevice of level difference section 54 grade, and formed these heights. Corresponding to a crevice, that magnitude of heights is minute and they must form the heights of this minute magnitude in the inside of a cavity with a sufficient precision.
[0004] Therefore, according to the above-mentioned conventional technique, in order to have to form the heights of minute magnitude in the inside of the cavity of metal mold, there is un-arranging [which says that manufacture of metal mold is very difficult and it is difficult to manufacture the thrust bearing 51 made of resin with a sufficient precision therefore].
[0005]
[Problem(s) to be Solved by the Invention] It aims at offering the manufacture approach of the thrust bearing made of resin which this invention can form comparatively easily crevices, such as the inclined plane section and the level difference section, in the sliding surface of the thrust bearing made of resin, has them in view of the above point, and can manufacture the thrust bearing made of resin with a sufficient precision comparatively easily.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the manufacture

approach of the thrust bearing made of resin by claim 1 of this invention In the manufacture approach of the thrust bearing made of resin of having crevices, such as the inclined plane section or the level difference section, in a sliding surface While fabricating said sliding surface to a plane, the meat theft section is fabricated to a non-sliding surface. The shaping location of said meat theft section in said non-sliding surface is a location corresponding to the part which does not form said crevice in said sliding surface, and it is characterized by forming said crevice in said sliding surface using the die shrinkage of the resin ingredient after shaping.

[0007] Moreover, the manufacture approach of the thrust bearing made of resin by claim 2 of this invention In the manufacture approach of the thrust bearing made of resin of having crevices, such as the inclined plane section or the level difference section, along one edge of said run slot while having a run slot in a sliding surface While fabricating said run slot to said sliding surface, the meat theft section is fabricated to a non-sliding surface. The shaping location of said meat theft section in said non-sliding surface is a location corresponding to the location of the flute width direction asymmetry of said run slot in said sliding surface, and it is characterized by forming said crevice in said sliding surface using the die shrinkage of the resin ingredient after shaping.

[0008] There is a property which generally says that the amount of die shrinkage after the direction of a part with thick thickness fabricating is larger than a part with that thin thickness in the resin ingredient which is a molding material of the thrust bearing made of resin, and this invention forms a crevice in the sliding surface of the thrust bearing made of resin for the inclined plane section, the level difference section, etc., using this property effectively.

[0009] In thrust bearing made of resin of sliding of only one side on which the technique which this invention offers has a minute inclination and a level difference aiming at the improvement in a sliding property the cavity by the side of a sliding surface with a flat surface By preparing meat theft in a non-sliding-surface side, and carrying out metal mold shaping in the configuration to which the resin thickness of shaft orientations was changed In the bearing which prepared the run slot which passes to inner circumference or a peripheral face at a sliding surface about the bearing made of resin which generates a minute inclination and a minute level difference By preparing meat theft so that it may become unsymmetrical to a run slot at a non-sliding-surface side, it is related with the bearing made of resin which generates a minute inclination and a level difference only in the fixed direction to a run slot.

[0010] Since it is difficult to prepare a minute inclination and a minute level difference in metal mold as described above, in this invention So that metal mold by the side of a sliding surface may be considered as as [flat surface] and the thickness of a part to prepare a minute inclination and a minute level difference (depression) may become thick A sliding surface is made to generate a minute crevice in a part with thickness thicker than a thin part using the property of the die shrinkage of resin in which the amount of die shrinkage becomes large, by considering as the configuration where meat theft was prepared from the non-sliding-surface side. Therefore, in this invention, since the die shrinkage of resin is used, it becomes possible to generate a minute inclination and a minute level difference (depression) by preparing meat theft in a comparatively rough precision rather than preparing a minute inclination and a level difference in the metal mold by the side of a sliding surface.

[0011] Moreover, according to this invention, by changing the magnitude of a thick difference, and the inclination of thick change, it is possible to change whenever [depth or tilt-angle], and a complicated quirk-like article also becomes generable [a minute inclination or a minute level difference (depression)] easily by making into the shape of a spiral slot or a herringbone quirk the configuration of meat theft prepared in a non-sliding-surface side. [of the level difference (depression) generated on a sliding surface]

[0012] Moreover, it becomes possible to create an inclination and a level difference easily only to the fixed direction side to a sliding-surface slot by arranging meat theft from inner circumference or a peripheral face in an unsymmetrical location to the run slot established in the sliding surface.

[0013]

[Embodiment of the Invention] The example of this invention is explained according to a drawing below.

[0014] The first example ... The manufacture approach of the bearing concerning the example concerned manufactures the thrust bearing 1 made of resin shown in drawing 1 (A), and the crevice of the inclined plane section 3 or level difference section 4 grade is established in the required-number radial as a dynamic pressure slot which acquires the dynamic pressure effectiveness at the time of actuation to the sliding surface 2 of this thrust bearing 1 made of resin. Although the crevice of this inclined plane section 3 or level difference section 4 grade is prepared as a slot on the radial, it replaces with this, and as shown in this drawing (B), it may be prepared as a herringbone slot, or may be prepared as a spiral slot (not shown), and especially that transverse-plane configuration (configuration seen from shaft orientations) is not limited.
[0015] The process is as follows in forming the inclined plane section 3 in the sliding surface 2 of the bearing 1 made of resin which presents the shape of a circular ring as a whole. In addition, as described above, the inclined plane section 3 is a crevice equipped with base 3a (refer to drawing 2) carried out a predetermined include-angle theta inclination to a sliding surface 2, and the bearing which formed the inclined plane section 3 may be called "tapered land bearing."
[0016] Namely, although the bearing 1 concerned is first fabricated by using predetermined resin as a molding material using metal mold As shown in drawing 2 (A), while fabricating the sliding surface 2 which is shaft-orientations one end face of the bearing 1 concerned to the plane of an axial right angle at this time Corresponding to the inclined plane section 3, the meat theft section 6 is fabricated to the non-sliding surface (it is also called an anti-sliding surface or a rear face) 5 which is a shaft-orientations other-end side, and it distinguishs between the thickness (shaft-orientations die length) of the bearing 1 concerned in a partial part (d1<d2). The meat theft section 6 is fabricated to the non-sliding surface 5, therefore the part which does not form the inclined plane section 3 in a sliding surface 2 sets up thickness d1 comparatively small, and the meat theft section 6 is not fabricated to the non-sliding surface 5 on the contrary, but, therefore, the part which forms the inclined plane section 3 in a sliding surface 2 sets up thickness d2 comparatively greatly. The part between the meat theft sections 6 which adjoin each other mutually is made into the lobe 7 which projects in relativity to the meat theft section 6, and this lobe 7 has the side faces 7b and 7c of end-face 7a and hoop direction both sides. End-face 7a fabricates this so that it may have predetermined width of face (hoop direction die length) in parallel with a sliding surface 2. One side-face 7b fabricates this so that it may intersect perpendicularly with a sliding surface 2. Side-face 7c of another side fabricates this in the shape of an inclined plane, in order to attach the inclination of the predetermined include angle theta to base 3a of the inclined plane section 3.
[0017] And if the bearing 1 fabricated in this way is taken out from metal mold and it leaves or cools at a predetermined time room temperature, the heat shrink after casting into a resin ingredient will occur, and as shown in drawing 2 (B), thereby, the inclined plane section 3 which equipped the sliding surface 2 with the predetermined configuration corresponding to the shape of toothing by the meat theft section 6 and the lobe 7 in the non-sliding surface 5 will be formed. Base 3a of the inclined plane section 3 is formed in the shape of [the predetermined include-angle theta inclination of was done to the sliding surface 2] an inclined plane, and it is formed so that that depth may become gradually shallow also as for side-face 3b applied to a sliding surface 2 from a crosswise edge with this deeper base 3a.
[0018] The transverse-plane configuration of the inclined plane section 3 can be changed with the transverse-plane configuration of the meat theft section 6 or a lobe 7, and the width of face of the inclined plane section 3 can be changed with spacing of the meat theft section 6 which adjoins each other mutually, or the width of face of a lobe 7. Moreover, the depth (shaft-orientations die length) of the inclined plane section 3 can be changed according to the difference of the depth of the meat theft section 6, the height of a lobe 7, or the above-mentioned thickness, and theta can change it whenever [tilt-angle / of base 3a of the inclined plane section 3] by whenever [tilt-angle / of side-face 7c of another side of a lobe 7].
[0019] According to the manufacture approach equipped with the above-mentioned process, it is not necessary to form the minute heights for inclined plane section formation in the inside of the cavity of metal mold like the above-mentioned conventional technique. therefore, make it any -- Since that volume of the heights for meat theft section formation which replace with the heights for this inclined

plane section formation, and are formed in the inside of the cavity of metal mold is more overwhelmingly [than the heights for inclined plane section formation] large, carrying out real relaxation of the dimensional accuracy about heights formation at this rate is permitted. Therefore, while manufacture of metal mold is easy-ized, it becomes possible to form the inclined plane section 3 in the sliding surface 2 of bearing 1 comparatively easily, and it becomes possible to manufacture comparatively easily the thrust bearing 1 made of resin which equipped the sliding surface 2 with the inclined plane section 3 with a sufficient precision.

[0020] The second example ... The process is as follows in forming the level difference section 4 in the sliding surface 2 of the bearing 1 made of resin which presents the shape of a circular ring as a whole again. In addition, as described above, the level difference section 4 is a crevice equipped with parallel base 4a (refer to drawing 3) to the sliding surface 2, and the bearing which formed the level difference section 4 may be called "Step DORANDO Bearing."

[0021] Namely, although the bearing 1 concerned is first fabricated by using predetermined resin as a molding material using metal mold As shown in drawing 3 (A), while fabricating the sliding surface 2 which is shaft-orientations one end face of the bearing 1 concerned to the plane of an axial right angle at this time Corresponding to the level difference section 4, the meat theft section 6 is fabricated to the non-sliding surface (it is also called an anti-sliding surface or a rear face) 5 which is a shaft-orientations other-end side, and it distinguishs between the thickness (shaft-orientations die length) of the bearing 1 concerned in a partial part (d1<d2). The meat theft section 6 is fabricated to the non-sliding surface 5, therefore the part which does not form the level difference section 4 in a sliding surface 2 sets up thickness d1 comparatively small, and the meat theft section 6 is not fabricated to the non-sliding surface 5 on the contrary, but, therefore, the part which forms the level difference section 4 in a sliding surface 2 sets up thickness d2 comparatively greatly. The part between the meat theft sections 6 which adjoin each other mutually is made into the lobe 7 which projects in relativity to the meat theft section 6, and this lobe 7 has the side faces 7b and 7c of end-face 7a and hoop direction both sides. End-face 7a fabricates this so that it may have predetermined width of face (hoop direction die length) in parallel with a sliding surface 2. One side-face 7b fabricates this so that it may intersect perpendicularly with a sliding surface 2. Side-face 7c of another side is fabricated so that a sliding surface 2 and this may also cross at right angles.

[0022] And if the bearing 1 fabricated in this way is taken out from metal mold and it leaves or cools at a predetermined time room temperature, the heat shrink after casting into a resin ingredient will occur, and as shown in drawing 3 (B), thereby, the level difference section 4 which equipped the sliding surface 2 with the predetermined configuration corresponding to the shape of toothing by the meat theft section 6 and the lobe 7 in the non-sliding surface 5 will be formed. Base 4a of the level difference section 4 is formed in parallel with a sliding surface 2, and the both-sides sides 4b and 4c applied to a sliding surface 2 from this base 3a are formed so that that depth may become shallow gradually, respectively.

[0023] The transverse-plane configuration of the level difference section 4 can be changed with the transverse-plane configuration of the meat theft section 6 or a lobe 7, and the width of face of the level difference section 4 can be changed with spacing of the meat theft section 6 which adjoins each other mutually, or the width of face of a lobe 7. Moreover, the depth (shaft-orientations die length) of the level difference section 4 can be changed according to the difference of the depth of the meat theft section 6, the height of a lobe 7, or the above-mentioned thickness.

[0024] According to the manufacture approach equipped with the above-mentioned process, it is not necessary to form the minute heights for level difference section formation in the inside of the cavity of metal mold like the above-mentioned conventional technique. therefore, make it any -- Since that volume of the heights for meat theft section formation which replace with the heights for this level difference section formation, and are formed in the inside of the cavity of metal mold is more overwhelmingly [than the heights for level difference section formation] large, carrying out real relaxation of the dimensional accuracy about heights formation at this rate is permitted. Therefore, while manufacture of metal mold is easy-ized, it becomes possible to form the level difference section 4 in the

sliding surface 2 of bearing 1 comparatively easily, and it becomes possible to manufacture comparatively easily the thrust bearing 1 made of resin which equipped the sliding surface 2 with the level difference section 4 with a sufficient precision.

[0025] The third example ... As shown in drawing 4 (A), to the thrust bearing 1 made of resin While establishing the run slot 8 for lubricating oil supply in the sliding surface 2 at a required-number radial There are some which formed the level difference section 4 with the depth respectively shallower than the run slot 8 along hoop direction one edge of this run slot 8, and that process is as follows in forming the run slot 8 and the level difference section 4 in the sliding surface 2 of the bearing 1 made of resin which presents the shape of a circular ring as a whole in this way.

[0026] Namely, although the bearing 1 concerned is first fabricated by using predetermined resin as a molding material using metal mold As a dotted line shows to drawing 4 (B), while fabricating the sliding surface 2 which is shaft-orientations one end face of the bearing 1 concerned to the plane of an axial right angle and fabricating the run slot 8 to this sliding surface 2 at a required-number radial at this time Corresponding to the level difference section 4, the meat theft section 6 is fabricated to the non-sliding surface (it is also called an anti-sliding surface or a rear face) 5 which is a shaft-orientations other-end side, and it distinguishs between the thickness (shaft-orientations die length) of the bearing 1 concerned in a partial part. The meat theft section 6 is fabricated to the non-sliding surface 5, the part which does not form the level difference section 4 in a sliding surface 2 sets thickness as it comparatively small, and the part which forms the level difference section 4 in a sliding surface 2 sets up thickness comparatively greatly on the contrary, without fabricating the meat theft section 6 to the non-sliding surface 5. The part between the meat theft sections 6 which adjoin each other mutually is made into the lobe 7 which projects in relativity to the meat theft section 6, and this lobe 7 has the side faces 7b and 7c of edge surface part 7a and hoop direction both sides. Edge surface part 7a fabricates this so that it may have predetermined width of face (hoop direction die length) in parallel with a sliding surface 2. One side-face 7b fabricates this so that it may intersect perpendicularly with a sliding surface 2. Side-face 7c of another side fabricates this in the shape of an inclined plane, in order to attach the inclination of a predetermined include angle to side-face 4b of the level difference section 4. Since the level difference section 4 is inclined and formed in hoop direction one edge of the run slot 8, let the hoop direction shaping location of the meat theft section 6 and a lobe 7 be the location of the flute width direction asymmetry of the run slot 8.

[0027] If the bearing 1 fabricated in this way is taken out from metal mold and it leaves or cools at a predetermined time room temperature, the heat shrink after casting into a resin ingredient will occur. And by this As a continuous line shows to drawing 4 (B), corresponding to the shape of toothing by the meat theft section 6 and the lobe 7 in the non-sliding surface 5, the level difference section 4 equipped with the predetermined configuration is formed in hoop direction one edge of the run slot 8 in a sliding surface 2. Base 4a of the level difference section 4 is formed in parallel with a sliding surface 2, and side-face 4b applied to a sliding surface 2 from this base 4a is formed so that that depth may become shallow gradually.

[0028] The transverse-plane configuration of the level difference section 4 can be changed with the transverse-plane configuration of the meat theft section 6 or a lobe 7, and the width of face of the level difference section 4 can be changed with spacing of the meat theft section 6 which adjoins each other mutually, or the width of face of a lobe 7. Moreover, the depth (shaft-orientations die length) of the level difference section 4 can be changed according to the difference of the depth of the meat theft section 6, the height of a lobe 7, or the above-mentioned thickness.

[0029] According to the manufacture approach equipped with the above-mentioned process, it is not necessary to form the minute heights for level difference section formation in the inside of the cavity of metal mold like the above-mentioned conventional technique. therefore, make it any -- Since that volume of the heights for meat theft section formation which replace with the heights for this level difference section formation, and are formed in the inside of the cavity of metal mold is more overwhelmingly [than the heights for level difference section formation] large, carrying out real relaxation of the dimensional accuracy about heights formation at this rate is permitted. Therefore, while

manufacture of metal mold is easy-ized, it becomes possible to form the level difference section 4 in the sliding surface 2 of the bearing 1 equipped with the run slot 8 comparatively easily, and it becomes possible to manufacture comparatively easily the thrust bearing 1 made of resin which equipped the sliding surface 2 with the run slot 8 and the level difference section 4 with a sufficient precision.
[0030]
[Effect of the Invention] This invention does the following effectiveness so.
[0031] Namely, it sets first to the manufacture approach of the bearing by claim 1 of this invention equipped with the above-mentioned configuration. In the approach of manufacturing the thrust bearing made of resin which has crevices, such as the inclined plane section or the level difference section, in a sliding surface Since the meat theft section is fabricated to a non-sliding surface and the crevice was formed in the sliding surface using the die shrinkage of the resin after shaping while fabricating the sliding surface to the plane It is not necessary to form the minute heights for crevice formation in the cavity inside of metal mold like the conventional technique. Since the volume of the heights for meat theft section formation which replace with the heights for this crevice formation, and are formed in the cavity inside of metal mold is overwhelmingly larger than the heights for crevice formation, easing the dimensional accuracy about heights formation substantially at this rate is permitted. Therefore, while manufacture of metal mold is easy-ized, crevices, such as the inclined plane section or the level difference section, can be formed in the sliding surface of the thrust bearing made of resin comparatively easily, and the thrust bearing made of resin which equipped the sliding surface with crevices, such as the inclined plane section or the level difference section, can be manufactured with a sufficient precision comparatively easily. Moreover, if manufacture of metal mold is easy-ized, low cost can be realized, and reduction and lightweight-izing of the cost of materials can also be realized by preparing the meat theft section in the bearing made of resin.
[0032] Moreover, it sets to the manufacture approach of the bearing by claim 2 of this invention equipped with the above-mentioned configuration. In the approach of manufacturing the thrust bearing made of resin which has crevices, such as the inclined plane section or the level difference section, along one edge of a run slot while having a run slot in a sliding surface Since the meat theft section is fabricated to a non-sliding surface and the crevice was formed in the sliding surface using the die shrinkage of the resin after shaping while fabricating the run slot to the sliding surface It is not necessary to form the minute heights for crevice formation in the cavity inside of metal mold like the conventional technique. Since the volume of the heights for meat theft section formation which replace with the heights for this crevice formation, and are formed in the cavity inside of metal mold is overwhelmingly larger than the heights for crevice formation, easing the dimensional accuracy about heights formation substantially at this rate is permitted. Therefore, while manufacture of metal mold is easy-ized, crevices, such as the inclined plane section or the level difference section, can be formed in the sliding surface of the thrust bearing made of resin equipped with the run slot comparatively easily, and the thrust bearing made of resin which equipped the sliding surface with crevices, such as a run slot and the inclined plane section, or the level difference section, can be manufactured with a sufficient precision comparatively easily. Moreover, if manufacture of metal mold is easy-ized, low cost can be realized, and reduction and lightweight-izing of the cost of materials can also be realized by preparing the meat theft section in the bearing made of resin.

[Translation done.]

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審査請求　未請求　請求項の数２　ＯＬ　（全７頁）

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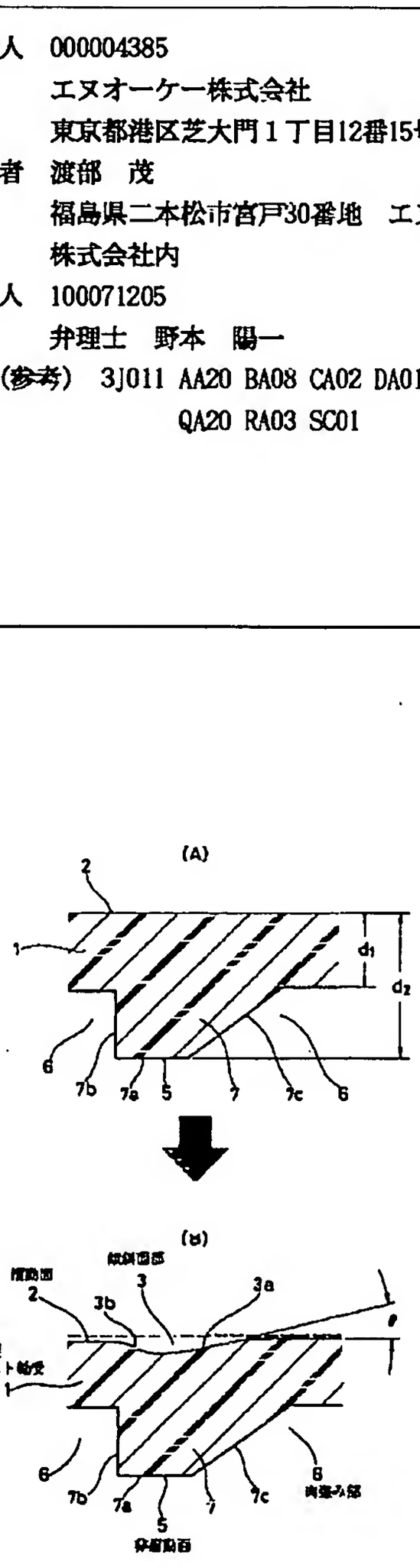
QA20 RA03 SC01

(54)【発明の名称】　樹脂製スラスト軸受の製造方法

(57)【要約】
【課題】　樹脂製スラスト軸受１の摺動面２に傾斜面部３や段差部等の凹部を比較的容易に形成することができ、もって樹脂製スラスト軸受１を比較的容易に精度良く製造することが可能な樹脂製スラスト軸受１の製造方法を提供する。
【解決手段】　摺動面２に傾斜面部３または段差部等の凹部を有する樹脂製スラスト軸受１の製造方法において、摺動面２を平面状に成形するとともに非摺動面５に肉盗み部６を成形し、非摺動面５における肉盗み部６の成形位置は摺動面２における凹部を形成しない部分に対応する位置であり、成形後における樹脂材料の成形収縮を利用して摺動面２に凹部を形成する。



【特許請求の範囲】
【請求項１】　摺動面（２）に傾斜面部（３）または段差部（４）等の凹部を有する樹脂製スラスト軸受（１）の製造方法において、
前記摺動面（２）を平面状に成形するとともに非摺動面（５）に肉盗み部（６）を成形し、前記非摺動面（５）における前記肉盗み部（６）の成形位置は前記摺動面（２）における前記凹部を形成しない部分に対応する位置であり、成形後における樹脂材料の成形収縮を利用して前記摺動面（２）に前記凹部を形成することを特徴とする樹脂製スラスト軸受の製造方法。
【請求項２】　摺動面（２）に通油溝（８）を有するとともに前記通油溝（８）の一方の縁に沿って傾斜面部（３）または段差部（４）等の凹部を有する樹脂製スラスト軸受（１）の製造方法において、
前記摺動面（２）に前記通油溝（８）を成形するとともに非摺動面（５）に肉盗み部（６）を成形し、前記非摺動面（５）における前記肉盗み部（６）の成形位置は前記摺動面（２）における前記通油溝（８）の溝幅方向非対称の位置に対応する位置であり、成形後における樹脂材料の成形収縮を利用して前記摺動面（２）に前記凹部を形成することを特徴とする樹脂製スラスト軸受の製造方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、樹脂製品の成形方法に係り、特に、樹脂製スラスト軸受の製造方法に関するものである。この樹脂製スラスト軸受は例えば、自動車等車両における回転軸のスラスト軸受部に利用される。
【０００２】
【従来の技術】従来から、図５（Ａ）に示す樹脂製スラスト軸受５１が知られており、この樹脂製スラスト軸受５１の摺動面５２には、作動時の動圧効果を得ることを目的として、同図（Ｂ）に示す傾斜面部５３や、同図（Ｃ）に示す段差部５４等の凹部が所要数放射状に設けられている。同図（Ｂ）の傾斜面部５３は摺動面５２に対して所定角度θ傾斜した底面５３ａを備えた凹部であり、この傾斜面部５３を設けた軸受は「テーパードランド軸受」と称されることがある。また、同図（Ｃ）の段差部５４は摺動面５２に対して平行な底面５４ａを備えた凹部であり、この段差部５４を設けた軸受は「ステップドランド軸受」と称されることがある。これらの傾斜面部５３や段差部５４等の凹部は、大きな動圧効果を得るために、その大きさを微小なものとして形成されている。
【０００３】しかしながら、従来の金型成形による樹脂製スラスト軸受５１の製造方法においては、成形品である樹脂製スラスト軸受５１にこれらの傾斜面部５３や段差部５４等の凹部を成形するために、金型（図示せず）の成形キャビティの内面に予めこれらの傾斜面部５３や段差部５４等の凹部に対応して凸部を形成し、この凸部を形成した金型を使用して樹脂製スラスト軸受５１を成形している。凸部は凹部に対応してその大きさが微小なものであり、この微小な大きさの凸部を精度良くキャビティの内面に形成しなければならない。
【０００４】したがって、上記従来技術によると、金型のキャビティの内面に微小な大きさの凸部を形成しなければならないために、金型の製作が極めて難しく、よって樹脂製スラスト軸受５１を精度良く製造するのが困難であると云う不都合がある。
【０００５】
【発明が解決しようとする課題】本発明は以上の点に鑑みて、樹脂製スラスト軸受の摺動面に傾斜面部や段差部等の凹部を比較的容易に形成することができ、もって樹脂製スラスト軸受を比較的容易に精度良く製造することが可能な樹脂製スラスト軸受の製造方法を提供することを目的とする。
【０００６】
【課題を解決するための手段】上記目的を達成するため、本発明の請求項１による樹脂製スラスト軸受の製造方法は、摺動面に傾斜面部または段差部等の凹部を有する樹脂製スラスト軸受の製造方法において、前記摺動面を平面状に成形するとともに非摺動面に肉盗み部を成形し、前記非摺動面における前記肉盗み部の成形位置は前記摺動面における前記凹部を形成しない部分に対応する位置であり、成形後における樹脂材料の成形収縮を利用して前記摺動面に前記凹部を形成することを特徴とするものである。
【０００７】また、本発明の請求項２による樹脂製スラスト軸受の製造方法は、摺動面に通油溝を有するとともに前記通油溝の一方の縁に沿って傾斜面部または段差部等の凹部を有する樹脂製スラスト軸受の製造方法において、前記摺動面に前記通油溝を成形するとともに非摺動面に肉盗み部を成形し、前記非摺動面における前記肉盗み部の成形位置は前記摺動面における前記通油溝の溝幅方向非対称の位置に対応する位置であり、成形後における樹脂材料の成形収縮を利用して前記摺動面に前記凹部を形成することを特徴とするものである。
【０００８】樹脂製スラスト軸受の成形材料である樹脂材料には一般に、その肉厚が薄い部分よりも肉厚が厚い部分の方が成形後における成形収縮量が大きいと云う特性があり、本発明はこの特性を有効に利用して、樹脂製スラスト軸受の摺動面に傾斜面部や段差部等を凹部を形成する。
【０００９】本発明の提供する技術は、摺動特性向上を目的とした微小傾斜や段差を有する片面のみ摺動の樹脂製スラスト軸受において、摺動面側のキャビティは平面のままで、非摺動面側に肉盗みを設け、軸方向の樹脂肉厚を変化させた形状で金型成形することにより、摺動面

に微小な傾斜や段差を生成する樹脂製軸受に関するものであり、また、内周もしくは外周面と通ずる通油溝を設けた軸受において、非摺動面側に通油溝に対し非対称となるように肉盗みを設けることにより、通油溝に対し一定方向のみに微小傾斜や段差を生成する樹脂製軸受に関するものである。

【００１０】上記したように、金型に微小な傾斜や段差を設けることは困難であることから本発明では、摺動面側の金型は平面のままとし、微小な傾斜や段差（凹み）を設けたい部分の肉厚が厚くなるように、非摺動面側から肉盗みを設けた形状とすることにより、肉厚が薄い部分よりも厚い部分で成形収縮量が大きくなる樹脂の成形収縮の性質を利用して、摺動面に微小の凹部を発生させる。したがって、本発明では、樹脂の成形収縮を利用していることから、摺動面側の金型に微小傾斜や段差を設けるよりも、比較的ラフな精度で肉盗みを設けることで微小な傾斜や段差（凹み）を生成することが可能となる。

【００１１】また、本発明によれば、肉厚の差の大きさおよび肉厚変化の勾配を変えることにより、摺動面上に生成される段差（凹み）の深さや傾斜角度を変化させることが可能であり、非摺動面側に設ける肉盗みの形状をスパイラル溝やヘリングボーン溝形状にすることにより、複雑な溝形状品でも容易に微小な傾斜や段差（凹み）が生成可能となる。

【００１２】また、内周もしくは外周面より摺動面に設けた通油溝に対し非対称位置に肉盗みを配置させることにより、摺動面溝に対し一定方向側にのみ傾斜や段差を容易に作成することが可能となる。

【００１３】

【発明の実施の形態】つぎに本発明の実施例を図面にしたがって説明する。

【００１４】第一実施例・・・当該実施例に係る軸受の製造方法は、図１（Ａ）に示す樹脂製スラスト軸受１を製造するものであり、この樹脂製スラスト軸受１の摺動面２には、作動時の動圧効果を得る動圧溝として、傾斜面部３または段差部４等の凹部が所要数放射状に設けられている。この傾斜面部３または段差部４等の凹部は放射状の溝として設けられているが、これに代えて、同図（Ｂ）に示すようにヘリングボーン溝として設けられたり、またはスパイラル溝（図示せず）として設けられたりする場合があり、その正面形状（軸方向から見た形状）は特に限定されるものではない。

【００１５】全体として円環状を呈する樹脂製軸受１の摺動面２に傾斜面部３を形成する場合には、その工程が以下のようになる。尚、上記したように傾斜面部３は摺動面２に対して所定角度θ傾斜した底面３ａ（図２参照）を備えた凹部であり、傾斜面部３を設けた軸受は「テーパードランド軸受」と称されることがある。

【００１６】すなわち先ず、当該軸受１を所定の樹脂を成形材料として金型を使用して成形するが、このとき、図２（Ａ）に示すように、当該軸受１の軸方向一方の端面である摺動面２を軸直角の平面状に成形するとともに、軸方向他方の端面である非摺動面（反摺動面または裏面とも称する）５に傾斜面部３に対応して肉盗み部６を成形し、当該軸受１の厚さ（軸方向長さ）に部分部分で差を付ける（$d_1 < d_2$）。非摺動面５に肉盗み部６を成形し、よって厚さd_1を比較的小さく設定するのは摺動面２に傾斜面部３を形成しない部分であり、反対に、非摺動面５に肉盗み部６を成形せず、よって厚さd_2を比較的大きく設定するのは摺動面２に傾斜面部３を形成する部分である。互いに隣り合う肉盗み部６の間の部分は肉盗み部６に対して相対に突出する突出部７とされ、この突出部７は端面７ａおよび周方向両側の側面７ｂ，７ｃを有している。端面７ａはこれを、摺動面２と平行であり、かつ所定の幅（周方向長さ）を備えるように成形する。一方の側面７ｂはこれを摺動面２と直交するように成形する。他方の側面７ｃはこれを、傾斜面部３の底面３ａに所定角度θの傾斜を付けるために、傾斜面状に成形する。

【００１７】そして、このように成形した軸受１を金型から取り出して所定時間室温で放置したり冷却したりすると、樹脂材料に成型後の熱収縮が発生し、これにより、図２（Ｂ）に示すように、非摺動面５における肉盗み部６および突出部７による凹凸形状に対応して摺動面２に所定形状を備えた傾斜面部３が形成される。傾斜面部３の底面３ａは摺動面２に対して所定角度θ傾斜した傾斜面状に形成され、この底面３ａの深い方の幅方向端部から摺動面２にかけての側面３ｂも、その深さが徐々に浅くなるように形成される。

【００１８】傾斜面部３の正面形状は、肉盗み部６または突出部７の正面形状により変更可能であり、傾斜面部３の幅は、互いに隣り合う肉盗み部６の間隔または突出部７の幅により変更可能である。また、傾斜面部３の深さ（軸方向長さ）は肉盗み部６の深さまたは突出部７の高さまたは上記厚さの差により変更可能であり、傾斜面部３の底面３ａの傾斜角度θは突出部７の他方の側面７ｃの傾斜角度により変更可能である。

【００１９】したがって、何れにしろ上記工程を備えた製造方法によれば、金型のキャビティの内面に上記従来技術のように傾斜面部形成用の微小な凸部を形成する必要がなく、この傾斜面部形成用の凸部に代えて金型のキャビティの内面に形成する肉盗み部形成用の凸部はそのボリュームが傾斜面部形成用の凸部よりも圧倒的に大きいものであるために、この分、凸部形成に関して寸法精度を実質緩和することが許容される。したがって、金型の製作が容易化されるとともに軸受１の摺動面２に傾斜面部３を比較的容易に形成することが可能となり、摺動面２に傾斜面部３を備えた樹脂製スラスト軸受１を比較的容易に精度良く製造することが可能となる。

【００２０】第二実施例・・・また、全体として円環状を呈する樹脂製軸受１の摺動面２に段差部４を形成する場合には、その工程が以下のようになる。尚、上記したように段差部４は摺動面２に対して平行な底面４ａ（図３参照）を備えた凹部であり、段差部４を設けた軸受は「ステップドランド軸受」と称されることがある。

【００２１】すなわち先ず、当該軸受１を所定の樹脂を成形材料として金型を使用して成形するが、このとき、図３（Ａ）に示すように、当該軸受１の軸方向一方の端面である摺動面２を軸直角の平面状に成形するとともに、軸方向他方の端面である非摺動面（反摺動面または裏面とも称する）５に段差部４に対応して肉盗み部６を成形し、当該軸受１の厚さ（軸方向長さ）に部分部分で差を付ける（$d_1 < d_2$）。非摺動面５に肉盗み部６を成形し、よって厚さd_1を比較的小さく設定するのは摺動面２に段差部４を形成しない部分であり、反対に、非摺動面５に肉盗み部６を成形せず、よって厚さd_2を比較的大きく設定するのは摺動面２に段差部４を形成する部分である。互いに隣り合う肉盗み部６の間の部分は肉盗み部６に対して相対に突出する突出部７とされ、この突出部７は端面７ａおよび周方向両側の側面７ｂ，７ｃを有している。端面７ａはこれを、摺動面２と平行であり、かつ所定の幅（周方向長さ）を備えるように成形する。一方の側面７ｂはこれを摺動面２と直交するように成形する。他方の側面７ｃはこれも摺動面２と直交するように成形する。

【００２２】そして、このように成形した軸受１を金型から取り出して所定時間室温で放置したり冷却したりすると、樹脂材料に成型後の熱収縮が発生し、これにより、図３（Ｂ）に示すように、非摺動面５における肉盗み部６および突出部７による凹凸形状に対応して摺動面２に所定形状を備えた段差部４が形成される。段差部４の底面４ａは摺動面２と平行に形成され、この底面３ａから摺動面２にかけての両側面４ｂ，４ｃはそれぞれ、その深さが徐々に浅くなるように形成される。

【００２３】段差部４の正面形状は、肉盗み部６または突出部７の正面形状により変更可能であり、段差部４の幅は、互いに隣り合う肉盗み部６の間隔または突出部７の幅により変更可能である。また、段差部４の深さ（軸方向長さ）は肉盗み部６の深さまたは突出部７の高さまたは上記厚さの差により変更可能である。

【００２４】したがって、何れにしろ上記工程を備えた製造方法によれば、金型のキャビティの内面に上記従来技術のように段差部形成用の微小な凸部を形成する必要がなく、この段差部形成用の凸部に代えて金型のキャビティの内面に形成する肉盗み部形成用の凸部はそのボリュームが段差部形成用の凸部よりも圧倒的に大きいものであるために、この分、凸部形成に関して寸法精度を実質緩和することが許容される。したがって、金型の製作が容易化されるとともに軸受１の摺動面２に段差部４を比較的容易に形成することが可能となり、摺動面２に段差部４を備えた樹脂製スラスト軸受１を比較的容易に精度良く製造することが可能となる。

【００２５】第三実施例・・・図４（Ａ）に示すように、樹脂製スラスト軸受１には、その摺動面２に潤滑油供給用の通油溝８を所要数放射状に設けるとともに、この通油溝８の周方向一方の縁に沿ってそれぞれ通油溝８よりも深さの浅い段差部４を設けたものがあり、このように全体として円環状を呈する樹脂製軸受１の摺動面２に通油溝８および段差部４を形成する場合には、その工程が以下のようになる。

【００２６】すなわち先ず、当該軸受１を所定の樹脂を成形材料として金型を使用して成形するが、このとき、図４（Ｂ）に点線で示すように、当該軸受１の軸方向一方の端面である摺動面２を軸直角の平面状に成形し、この摺動面２に通油溝８を所要数放射状に成形するとともに、軸方向他方の端面である非摺動面（反摺動面または裏面とも称する）５に段差部４に対応して肉盗み部６を成形し、当該軸受１の厚さ（軸方向長さ）に部分部分で差を付ける。非摺動面５に肉盗み部６を成形して厚さを比較的小さく設定するのは、摺動面２に段差部４を形成しない部分であり、反対に、非摺動面５に肉盗み部６を成形せずに厚さを比較的大きく設定するのは、摺動面２に段差部４を形成する部分である。互いに隣り合う肉盗み部６の間の部分は肉盗み部６に対して相対に突出する突出部７とされ、この突出部７は端面部７ａおよび周方向両側の側面７ｂ，７ｃを有している。端面部７ａはこれを、摺動面２と平行であり、かつ所定の幅（周方向長さ）を備えるように成形する。一方の側面７ｂはこれを摺動面２と直交するように成形する。他方の側面７ｃはこれを、段差部４の側面４ｂに所定角度の傾斜を付けるために、傾斜面状に成形する。段差部４が通油溝８の周方向一方の縁に片寄って形成されるため、肉盗み部６および突出部７の周方向成形位置は通油溝８の溝幅方向非対称の位置とされる。

【００２７】そして、このように成形した軸受１を金型から取り出して所定時間室温で放置したり冷却したりすると、樹脂材料に成型後の熱収縮が発生し、これにより、図４（Ｂ）に実線で示すように、非摺動面５における肉盗み部６および突出部７による凹凸形状に対応して摺動面２における通油溝８の周方向一方の縁に所定形状を備えた段差部４が形成される。段差部４の底面４ａは摺動面２と平行に形成され、この底面４ａから摺動面２にかけての側面４ｂは、その深さが徐々に浅くなるように形成される。

【００２８】段差部４の正面形状は、肉盗み部６または突出部７の正面形状により変更可能であり、段差部４の幅は、互いに隣り合う肉盗み部６の間隔または突出部７の幅により変更可能である。また、段差部４の深さ（軸方向長さ）は肉盗み部６の深さまたは突出部７の高さま

たは上記厚さの差により変更可能である。

【0029】したがって、何れにしろ上記工程を備えた製造方法によれば、金型のキャビティの内面に上記従来技術のように段差部形成用の微小な凸部を形成する必要がなく、この段差部形成用の凸部に代えて金型のキャビティの内面に形成する肉盗み部形成用の凸部はそのボリュームが段差部形成用の凸部よりも圧倒的に大きいものであるために、この分、凸部形成に関して寸法精度を実質緩和することが許容される。したがって、金型の製作が容易化されるとともに通油溝8を備えた軸受1の摺動面2に段差部4を比較的容易に形成することが可能となり、摺動面2に通油溝8および段差部4を備えた樹脂製スラスト軸受1を比較的容易に精度良く製造することが可能となる。

【0030】

【発明の効果】本発明は、以下の効果を奏する。

【0031】すなわち先ず、上記構成を備えた本発明の請求項1による軸受の製造方法においては、摺動面に傾斜面部または段差部等の凹部を有する樹脂製スラスト軸受を製造する方法において、摺動面を平面状に成形するとともに非摺動面に肉盗み部を成形し、成形後における樹脂の成形収縮を利用して摺動面に凹部を形成するようにしたために、金型のキャビティ内面に従来技術のように凹部形成用の微小な凸部を形成する必要がなく、この凹部形成用の凸部に代えて金型のキャビティ内面に形成する肉盗み部形成用の凸部のボリュームが凹部形成用の凸部よりも圧倒的に大きいために、この分、凸部形成に関しての寸法精度を実質的に緩和することが許容される。したがって、金型の製作が容易化されるとともに樹脂製スラスト軸受の摺動面に傾斜面部または段差部等の凹部を比較的容易に形成することができ、摺動面に傾斜面部または段差部等の凹部を備えた樹脂製スラスト軸受を比較的容易に精度良く製造することができる。また、金型の製作が容易化されれば低コストを実現することができ、樹脂製軸受に肉盗み部を設けることにより、材料費の低減および軽量化を実現することもできる。

【0032】また、上記構成を備えた本発明の請求項2による軸受の製造方法においては、摺動面に通油溝を有するとともに通油溝の一方の縁に沿って傾斜面部または段差部等の凹部を有する樹脂製スラスト軸受を製造する方法において、摺動面に通油溝を成形するとともに非摺動面に肉盗み部を成形し、成形後における樹脂の成形収縮を利用して摺動面に凹部を形成するようにしたために、金型のキャビティ内面に従来技術のように凹部形成用の微小な凸部を形成する必要がなく、この凹部形成用の凸部に代えて金型のキャビティ内面に形成する肉盗み部形成用の凸部のボリュームが凹部形成用の凸部よりも圧倒的に大きいために、この分、凸部形成に関しての寸法精度を実質的に緩和することが許容される。したがって、金型の製作が容易化されるとともに通油溝を備えた樹脂製スラスト軸受の摺動面に傾斜面部または段差部等の凹部を比較的容易に形成することができ、摺動面に通油溝ならびに傾斜面部または段差部等の凹部を備えた樹脂製スラスト軸受を比較的容易に精度良く製造することができる。また、金型の製作が容易化されれば低コストを実現することができ、樹脂製軸受に肉盗み部を設けることにより、材料費の低減および軽量化を実現することもできる。

【図面の簡単な説明】

【図1】（A）は本発明の第一または第二実施例に係る製造方法により製造される樹脂製スラスト軸受の一例を示す正面図、（B）は他の例を示す正面図

【図2】本発明の第一実施例に係る製造方法の工程説明図であって、（A）は成形収縮前の状態を示す軸受の要部断面図、（B）は成形収縮後の状態を示す軸受の要部断面図

【図3】本発明の第二実施例に係る製造方法の工程説明図であって、（A）は成形収縮前の状態を示す軸受の要部断面図、（B）は成形収縮後の状態を示す軸受の要部断面図

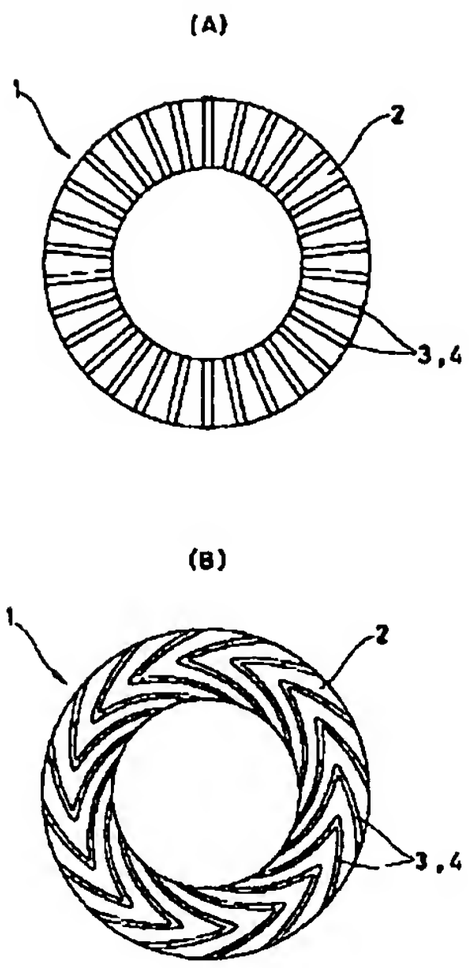
【図4】（A）は本発明の第三実施例に係る製造方法により製造される樹脂製スラスト軸受の一例を示す正面図、（B）は同実施例に係る製造方法の工程説明図であって軸受の要部断面図

【図5】（A）は樹脂製スラスト軸受の正面図、（B）は傾斜面部の拡大断面図、（C）は段差部の拡大断面図

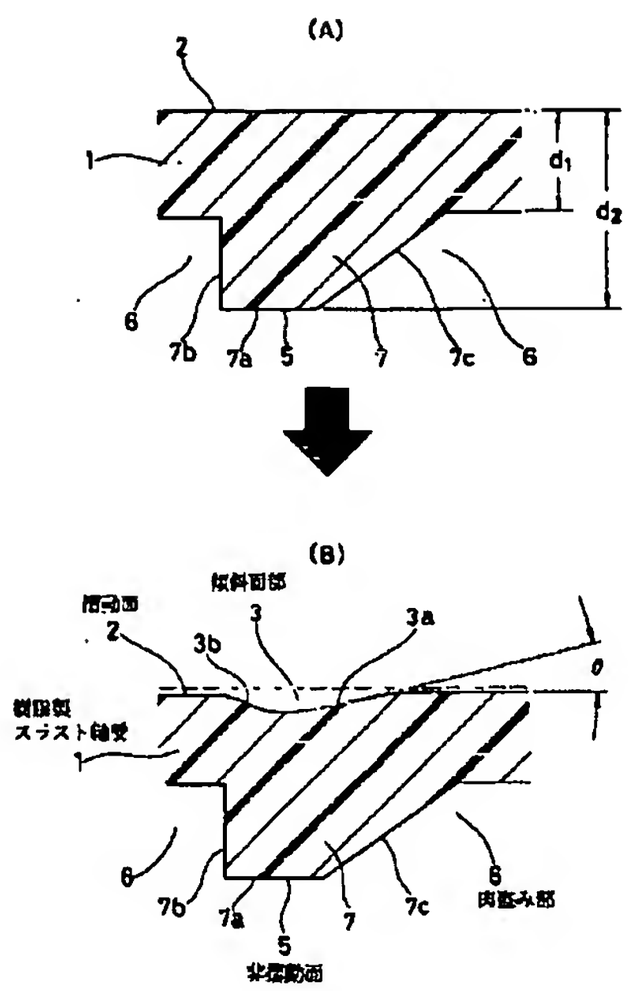
【符号の説明】

1　樹脂製スラスト軸受
2　摺動面
3　傾斜面部
3a，4a　底面
3b，4b，4c，7b，7c　側面
4　段差部
5　非摺動面
6　肉盗み部
7　突出部
7a　端面
8　通油溝

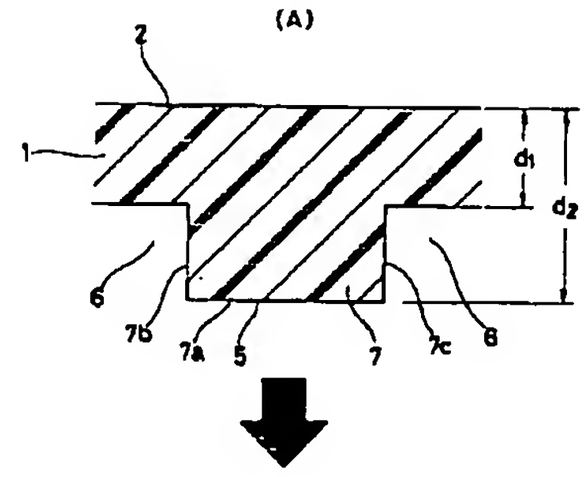
【図1】


(A)
1
2
3,4
(B)
1
2
3,4

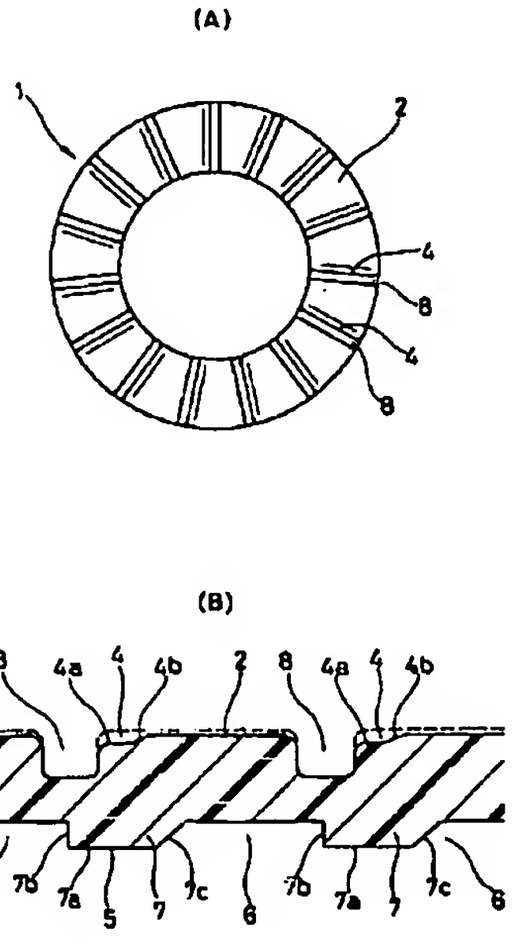
【図2】


(A)
2
1
d1
d2
6
7b
7a
5
7
7c
6
(B)
傾斜面部
摺動面
2
3
3a
3b
θ
樹脂製
スラスト軸受
1
6
7b
7a
7
7c
6
肉盗み部
5
非摺動面

【図3】


(A)
2
1
d1
d2
6
7b
7a
5
7
7c
8
(B)
2
4b
4a
4
4c
1
6
7b
7a
5
7
7c
8

【図4】


(A)
1
2
4
8
4
8
(B)
8
4a
4
4b
2
8
4a
4
4b
1
6
7b
7a
5
7
7c
8
7b
7a
7
7c
8

【図5】